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Potential Effects of Single Use Plastics Ban on Ontario Manufacturers

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Abstract

During the past few decades, plastics pollution has become a global concern. Governments are striving to find the best way to reduce plastics consumption and waste. The Government of Canada has proposed a ban on single-use plastics to be implemented in 2021, a potentially disruptive public policy. Many studies have been conducted on the environmental impacts of plastics and the benefits of a plastics ban, but little has been written about the potential effects of these policies on plastics manufacturers. An economic model was developed to analyze the effects on Ontario single use plastics manufacturers. Results of the model show that most plastics manufacturers would be able to recover their investments within three years for the costs of converting to an alternative material. However, there is an aggregated cost on manufacturers of approximately $262 million for the first three years. Additionally, a small number of specialized manufacturers would not be able to recover from the ban, potentially leading to some job losses. Overall, however, the results indicate that manufacturers would be able to adjust to the ban in the longer-term, providing for the environmental benefits of reduced plastics consumption and waste.

1. Introduction

Plastics are ubiquitous in our products and packaging. Unfortunately, the very benefits that make plastics attractive as a component of many products are detrimental to the environment [1]. Most plastics end up as garbage in waste management facilities and landfills. Their extraordinarily long-lives mean that plastics stay in the environment for decades to centuries. Once in the environment, plastics can cause problems for wildlife and humans by contaminating water sources and changing natural biological processes [2]. Moreover, plastics are made from petrochemicals, which release greenhouse gases, causing global warming [3].

Single-use plastics (SUP, also known as disposable plastics) items are products that are intended to be thrown away or recycled immediately after they are used [4]. These items include products such as plastic drinking straws, stirrers, cotton swabs, cutlery, plates, balloon sticks, Oxo-biodegradable food containers, and expanded polystyrene cups. Few of these plastics are recycled. Thus, these plastics present a substantial waste management problem, because plastics are not biodegradable.

In 2019, Prime Minister Justin Trudeau proposed a ban on single-use plastics as a part of his environmental election platform [5]. With the re-election of the Liberals, the plastics ban became an official policy and is set to come into effect by the end of 2021 [6]. This policy aligns with trends throughout the world.

The literature shows that a significant number of studies investigate and assess the environmental and social aspects of a single-use plastics ban. However, the influence on plastics manufacturers and the economy has been neglected. The plastics industry in Canada has estimated annual sales of $35 billion and employs 93,000 people in 1,932 businesses [7]. Ontario is among the biggest plastics producers in Canada [8]. The importance of the plastics industry in Ontario's economy and the lack of studies on economic aspects of single-use plastics ban emphasizes the significance of this study.

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2. Methodology

According to Statistics Canada, there are 1,170 establishments in Ontario working in the plastics industry, among which 342 are non-employer/intermediate establishments and 828 are employer establishments [9]. From this starting point, a database of all the plastics manufacturers in Ontario was created through company registries, trade associations, and internet searches. The database included the name of the companies, approximate annual revenue, the number of employees working at the company, their locations, and the products they produce.

After locating available information about plastics companies in Ontario, their locations and products were found through individual searches through the website of each company. Then, companies were classified into "single-use plastics" producers and "other plastics" producers based on the products they produce. In this study, companies that are partially involved with single-use plastics are also considered as single-use plastics producers. Of the 1,170 plastics manufacturers in Ontario, 139 of them produce SUP. Most of these manufacturers are located in Southern Ontario, with 79% located in the Greater Toronto Area (GTA). For each of the SUP manufacturers, the annual revenue and number of employees working at each company was found using The Dun & Bradstreet, Zoominfo, FRASERS, and Manta online resources.

An investigation of the SUP products made by each SUP manufacturer was done. For every product that is likely to be banned by the end of 2021, a viable alternative material and the required production equipment for that material was identified. This information is used in a cost-benefit analysis to determine the impact of the ban on Ontario SUP manufacturers.

Though there are many criteria that can be considered for making decisions about selecting an alternative, the focus of this study is on assigning an alternative material to each SUP product based on function and cost. Some of the SUP products are easy to find a replacement for, either from the perspective of manufacturers or consumers. On the other hand, some plastics products are difficult to be made with substitute materials. For instance, stretch films and sheets are not easily manufactured with other materials. Some bioplastics are also on the market, such as PLA. PLA or polylactic acid is a thermoplastic polyester made from organic material such as corn starch or sugar cane [10]. Often, substituting an alternative material for plastic in a product will change the product's characteristics and production requirements. Therefore, this study considers only the most *feasible* alternative materials for products based on cost, as shown in Table 1.

Table 1. Production Process and Materials

Plastics Product	**Alternative Material**
Beverage Bottles	Aluminum
Bags*	Paper
Cups/Jars	Glass
Cutlery	Wood
Straws/ Stirrer Sticks	Paper (straw) Wood(stirrer)
Expanded Polystyrene Products Containers	PLA (polylactic acid)
Sheets**	PLA (polylactic acid)
(Laminated) Pouch	Paper
Stretch Film	PLA (polylactic acid)
Blister packaging, clamshell Packaging; Tale-out Container	PLA (polylactic acid)

* Including retail bag, wicket bag, poly bag, garbage bag, T-shirt bag, zipper bag, and flexible (food) packaging.

** Including pallet cover sheet, shrink film, bubble wrap, and roll stock

The material used as the alternative to plastics is selected based on its functionality, viability, availability, and cost of the material. Accordingly, aluminum, wood, paper, polylactic acid, and glass are selected as alternatives for petrochemical plastics. In this study, only the main raw materials which have the greatest impact on costs are used. For instance, the main material used for producing paper bags is kraft paper, whereas the amount of glue is negligible and is not included in the material cost in the model. The impact on the availability and supply of the alternative material is beyond the scope of this study.

The single-use plastics products assessed in this study are made from a variety of plastic types, including PET, HDPE, PVC, LDPE, PP, and PS. To determine the material cost, the net weight of products is used to estimate the amount of material needed to produce an item [11]. Moreover, the capacity and availability of the machines determine how many pieces of each item is produced every year. The information of product net weight along with the capacity of machines, helps establish the material cost of production.

The amount of material required for production is empirically collected by weighing and averaging a sample of each type of product. The prices of raw materials are obtained from some suppliers or manufacturers offering the relevant raw material. The material cost of each product is then calculated by multiplying the average weight by the price of the raw material. Then, by multiplying this number by the production capacity of the production machines, the annual material cost of production for each item is calculated.

This study uses net present value and payback period methods for evaluation of the capital investment to switch to alternative materials. Net present value (NPV) is a method broadly used in capital budgeting for determining the present value of cashflows (inflows and outflows) of a project [12]. It identifies which project is more profitable by translating the investment into today's dollar, using the following formula:

$$NPV = \sum_{t=1}^{n} \frac{R_t}{(1+i)^n}$$

where,
R_t = cashflow of the period t;
i = discount rate; and
n = number of periods.
A discount rate of 2% is used for the model. The number of periods is set to 3 years.

In the current study, it is considered that a non-negative total NPV means that substituting plastics with alternative materials that are non-petrochemical plastics is profitable for the manufacturer. Contrarily, if the total net present value is negative, the next step is to analyze the consequences of material substitution by calculating the payback period. Payback period (PBP) method determines the amount of time required for an investment to reach to the break-even point. In other words, it predicts how fast the invested cash will be recovered [13]. In this study, a three-year payback period is the acceptable period for the company to switch to alternative materials and keep producing. If the payback period is more than three years, the manufacturer will have to cease production.

3. Results and Discussion

As mentioned above, substitute materials for each product are selected based on functionality, viability, availability, and cost. Although innovation in product design would make production more cost efficient, novelty and innovation are not considered when assessing substitute materials or production equipment. The Cost-Benefit Analysis in this study only considers the direct capital and material costs to the manufacturers as costs and the benefits being the preservation of revenues, coupled with any tax benefits from capital purchases. The environmental costs and benefits are considered exogenous to the firm, and thus, are not included in the Cost-Benefit Analysis for this study [11].

3.1 Material Cost Comparison

Table 2 shows the annual material cost of each product per production line based on their net weight and the capacity of the machines.

The numbers in Table 2 show that there is an average of 33.3% increase in costs by substituting alternative materials over the original plastic material. These costs range from a slight decrease in costs for pouches to an 80.5% increase in costs for jars. Thus, the changes in material costs can be substantial for manufacturers.

Table 2. Material Cost Comparison

Original Product	Plastics Material Cost	Alternative Material Cost	% change in cost
Beverage bottle	$ 198,426	$ 256,000	22.5%
Retail bag	$ 57,595	$ 119,002	51.6%
Cutlery	$ 51,124	$ 106,313	51.9%
Caps and closure	$ 61,349	$ 82,286	25.4%
Straw	$ 22,086	$ 36,450	39.4%
Stick stirrer	$ 19,632	$ 36,450	46.1%
Poly mailer bag	$ 76,794	$ 157,533	51.3%
Pouch	$ 159,987	$ 157,533	-1.6%
Zipper bag	$ 127,990	$ 157,533	18.8%
Poly bag/ wicket	$ 57,595	$ 119,002	51.6%
Snack web	$ 42,557	$ 96,944	56.1%
Jar	$ 198,426	$ 1,019,239	80.5%
Take-out container	$ 104,702	$ 109,700	4.6%
Film	$ 39,997	$ 53,565	25.3%
EPS container	$ 62,651	$ 109,700	42.9%
Flexible food packaging	$ 159,987	$ 171,407	6.7%
Blister packaging	$ 76,279	$ 85,703	11.0%
Clamshell packaging	$ 72,155	$ 85,703	15.8%

The calculations for the alternative material costs are used in the Cost-Benefit Analysis.

3.2 Cost-Benefit Analysis

Three factors contribute to benefits for manufacturers: annual revenue, capital cost allowance, and tax return. Three business directories were used to collect information about total annual revenue of firms. For the study, the annual revenue for each company is taken as proportional to the firm's production volume. This provides a means to allocate revenue to single-use plastics products for each company. For example, if a manufacturer with an annual revenue of $7,000,000 (Canadian dollars) is producing single-use water bottles as 50% of its production, then revenues of $3,500,000 (Canadian dollars) are allocated for SUP in the firm. The same calculation is done for all single-use plastics producers on the dataset to understand what portion of the costs and revenue belong to single-use plastics. Employees are allocated the same way. The amount of allocated revenue to single-use plastics production lines are used in the cost-benefit analysis.

In this study, the cost-benefit model analyzes the impact of the ban for three years, starting from 2020 (n=0). Available data on manufacturers' annual revenue belong to 2017, 2018, and 2019. Therefore, it is assumed that the growth rate for revenues equals to zero at first and the amount of revenues found for firms are used as the revenue for 2020.

Capital Cost Allowance (CCA) is a percentage of a depreciable property for the period that the property becomes obsolete in business activities and is deducted from Canadian income tax. Canada Revenue Agency (CRA) classifies capital cost allowance rates of a variety of assets into 19 distinct classes (also known as asset pools). Machinery and equipment used in a business belong to the class 8 with a rate of 20% (Canada Revenue Agency, 2020). CCA is calculated regardless of the date that the asset is purchased, therefore, the "half-year convention" or "50% rule" is set up to align the costs and revenue better. The rule allows 50% of the relevant rate to be used for the base year, which is when the asset is purchased [14]. Based on the half-year rule, the applied CCA rate for the year in which alternative machines are purchased equals 10%. For the next three years, however, the normal fixed CCA of 20% is applied.

For calculating the NPV of Capital Cost Allowance achieved from alternative machines and equipment depreciation, the total amount of purchasing price for production lines of each company is calculated. The value of the total NPV for Capital Cost Allowance of all three years is added to the total benefit.

Eligible Canadian corporations can claim a corporation income tax return for every tax year. According to the Canada Revenue Agency (CRA), the general federal and provincial (Ontario) rates are 15% and 11.5%, respectively. Small businesses can also claim the small business tax deduction (SBD), but the rates vary for small businesses. The federal rate for small businesses is 9% and the provincial rate is 3.2%. Therefore, the combined federal and provincial rates are 12.2% for small corporations and 26.5% for other corporations [15].

The tax year starts at the end of the base year, meaning that corporations will not benefit from corporation income tax in the base year. Based on the annual revenue of 139 SUP manufacturers in Ontario, the corporation tax was calculated for the first, second, and third year. If the annual revenue of a firm was less than $500,000, the applicable combined tax rate equals 12.2%. If it is greater than $500,000, 26.5% is applied to calculate the annual corporation income tax and the NPV for taxes is calculated. The summation of tax benefit values gives the total NPV of tax benefits of manufacturers for the intended period. It should be noted that the tax rates are determined based on the single-use plastics allocated revenue, not the total revenue of the firm.

3.3 Results of the Cost-Benefit Analysis

By deducting the net present value of benefits from the net present value of costs, the overall NPV for benefits is calculated which determines how companies could be affected by plastics substitution. The results of the Cost-Benefit Analysis show that 130 out of the current 139 SUP manufacturers will see net positive returns over the three years if they convert production to use an alternative material, protecting their revenues and jobs. This is even while assuming that there is no increase in revenues (i.e., that the manufacturers do not raise prices for their customers). Although these 130 SUP companies could still make profit out of producing alternative products, the net present value of their benefits would decrease due to the costs of substitution. On average, SUP manufacturers in Ontario would see a net decrease of 19.2% of their profits (i.e., revenues – expenses) over the three years as they shift from single use plastics to an alternative material and incur costs of approximately $1,884,796. The changes in profits ranges from minimal losses to the complete loss of revenues for that product line.

Nine companies of the 139 SUP manufacturers would have a negative net present value for any change, and thus, it is anticipated that they would cease production for that product. The negative net present value of the CBA in the model suggests that the material substitution is not a viable strategy for responding to the plastics materials ban for these companies. These manufacturers would be unable to bear the costs of substitution, particular the capital costs. While it is possible for companies to purchase used machines or use less costly alternative materials to cut their costs, this study assumes that all manufacturers would purchase new machinery and have a required payback period of 3 years. If the required payback period is lengthened or substitute machine and material costs are reduced, this would obviously change the calculation and may make it more desirable to continue production.

4. Concluding Remarks

The SUP ban in Canada which is set to go into effect in 2021 will impact the SUP manufacturers in Ontario. For nine of the 139 manufacturers, they will cease production, resulting in an anticipated job loss of approximately 30 people. It is also possible that some manufacturers will need to adjust their workforce in order to deal with new material and production requirements, possibly resulting in some new positions and some loss in current positions. Though these firms are concentrated in the GTA within Ontario, the potential losses are small relative to the size of the labour market and, thus, are not expected to be a significant disruption.

The benefits of banning single-use plastics really accrue to society, rather than to manufacturers themselves. If manufacturers adapt themselves to the ban by using alternative methods and materials, the benefit is that they would be able to stay in the market, keep producing, and earning revenues. However, it is also possible that the manufacturers are unable to substitute plastics with alternative materials in a cost effective and timely manner, either because the costs exceed the benefits even if an alternative source of raw materials and a production method is available, or because there is no viable material to substitute for plastics.

The goal of this study was to look at the implications of the proposed SUP ban on Ontario manufacturers through a cost-benefit analysis. This study is limited by the availability of the data used to develop the model and the assumptions over production and payback period. Therefore, the results should be taken as indications of the effects of the ban, rather than as absolute outcomes. The results show that the total costs for the SUP manufacturers in

Ontario to comply with the ban is approximately $262 million (Canadian). Therefore, it is reasonable that the federal and provincial governments should look at policies that can assist manufacturers in the costs of transitioning from SUP production. For instance, the federal government could allow for acceleration of CCA deductions from corporate income taxes, which would offset some of the capital costs. They could also supplement any retraining costs for affected employees. The federal government could also provide some offset for costs in terms of an environmental tax credit for lost revenues or increased costs directly attributable to the SUP ban for a limited period of time, helping companies to absorb the costs of finding the appropriate substitute material and related equipment. Lastly, the federal government should promote the benefits of banning SUP and make citizens aware of the affect on local manufacturers, encouraging people to support the efforts of these manufacturers through their purchasing decisions. In addition, the government must also address the critical question of whether this ban includes an importation ban or is merely a production ban in Ontario.

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